RED SEAL

THE INTERPROVINCIAL STANDARDS RED SEAL PROGRAM

National Occupational Analysis

2009 | Welder

Human Resources and Skills Development Canada
Ressources humaines et Développement des compétences Canada
Canada

Occupational Analyses Series

Welder

2009

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The Canadian Council of Directors of Apprenticeship (CCDA) recognizes this National Occupational Analysis as the national standard for the occupation of Welder.

Background

The first National Conference on Apprenticeship in Trades and Industries, held in Ottawa in 1952, recommended that the federal government be requested to cooperate with provincial and territorial apprenticeship committees and officials in preparing analyses of a number of skilled occupations. To this end, Human Resources and Skills Development Canada sponsors a program, under the guidance of the CCDA, to develop a series of National Occupational Analyses (NOA).

The NOAs have the following objectives:

- to describe and group the tasks performed by skilled workers;
- to identify which tasks are performed in every province and territory;
- to develop instruments for use in the preparation of Interprovincial Red Seal Examinations and curricula for training leading to the certification of skilled workers;
- to facilitate the mobility of apprentices and skilled workers in Canada; and,
- to supply employers, employees, associations, industries, training institutions and governments with analyses of occupations.

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LIST OF PUBLISHED NATIONAL OCCUPATIONAL ANALYSES (Red Seal Trades)

TITLE	NOC* Code
Agricultural Equipment Technician (2007)	7312
Appliance Service Technician (2005)	7332
Automotive Painter (2005)	7322
Automotive Service Technician (2009)	7321
Baker (2006)	6252
Boilermaker (2008)	7262
Bricklayer (2007)	7281
Cabinetmaker (2007)	7272
Carpenter (2005)	7271
Concrete Finisher (2006)	7282
Construction Electrician (2008)	7241
Construction Craft Worker (2009)	7611
Cook (2008)	6242
Electrical Rewind Mechanic (1999)	7333
Electronics Technician – Consumer Products (1997)	2242
Floorcovering Installer (2005)	7295
Glazier (2008)	7292
Hairstylist (2009)	6271
Heavy Duty Equipment Technician (2004)	7312
Industrial Electrician (2008)	7242
Industrial Mechanic (Millwright) (2007)	7311
Instrumentation and Control Technician (2007)	2243
Insulator (Heat and Frost) (2007)	7293
Ironworker (Generalist) (2006)	7264
Ironworker (Reinforcing) (2006)	7264
Ironworker (Structural/Ornamental) (2006)	7264
Lather (Interior Systems Mechanic) (2007)	7284
Machinist (2005)	7231

* National Occupational Classification

TITLE	NOC* Code
Metal Fabricator (Fitter) (2008)	7263
Mobile Crane Operator (2006)	7371
Motorcycle Mechanic (2006)	7334
Motor Vehicle Body Repairer (Metal and Paint) (2005)	7322
Oil Heat Systems Technician (2006)	7331
Painter and Decorator (2007)	7294
Partsperson (2005)	1472
Plumber (2008)	7251
Powerline Technician (2009)	7244
Recreation Vehicle Service Technician (2006)	7383
Refrigeration and Air Conditioning Mechanic (2004)	7313
Rig Technician (2008)	8232
Roofer (2006)	7291
Sheet Metal Worker (2006)	7261
Sprinkler System Installer (2003)	7252
Steamfitter — Pipefitter (2008)	7252
Tilesetter (2004)	7283
Tool and Die Maker (2005)	7232
Transport Trailer Technician (2008)	7321
Truck and Transport Mechanic (2007)	7321
Welder (2009)	7265

Requests for printed copies of National Occupational Analyses may be forwarded to:

Trades and Apprenticeship Division
Workplace Partnership Directorate
Human Resources and Skills Development Canada
140 Promenade du Portage, Phase IV, 5th Floor
Gatineau, Quebec K1A 0J9

These publications can be ordered or downloaded online at: www.red-seal.ca. Links to Essential Skills Profiles for some of these trades are also available on this website.

To facilitate understanding of the occupation, the work performed by tradespersons is divided into the following categories:

Blocks	the largest division within the analysis that is comprised of a distinct set of trade activities
Tasks	distinct actions that describe the activities within a block
Sub-Tasks	distinct actions that describe the activities within a task
Supporting Knowledge and Abilities	skills and knowledge that an individual must have to perform a sub-task

The analysis also provides the following information:

Trends	changes identified that impact or will impact the trade including work practices, technological advances, and new materials and equipment
Context	information to clarify the intent and meaning of tasks
Related Components	a list of products, items, materials and other elements relevant to the block
Tools and Equipment	categories of tools and equipment used to perform all tasks in the block; these tools and equipment are listed in Appendix A

The appendices located at the end of the analysis are described as follows:

Appendix A — Tools and Equipment	a non-exhaustive list of tools and equipment used in this trade
Appendix B — Glossary	definitions or explanations of selected technical terms used in the analysis
Appendix C — Acronyms	a list of acronyms used in the analysis with their full name
Appendix D — Block and Task Weighting	the block and task percentages submitted by each jurisdiction, and the national averages of these percentages; these national averages determine the number of questions for each block and task in the Interprovincial exam
Appendix E — Pie Chart	a graph which depicts the national percentages of exam questions assigned to blocks
Appendix F — Task Profile Chart	a chart which outlines graphically the blocks, tasks and sub-tasks of this analysis

Development of Analysis

A draft analysis is developed by a committee of industry experts in the field led by a team of facilitators from Human Resources and Skills Development Canada. This draft analysis breaks down all the tasks performed in the occupation and describes the knowledge and abilities required for a tradesperson to demonstrate competence in the trade.

Draft Review

The National Occupational Analysis (NOA) development team then forwards a copy of the analysis and its translation to provincial and territorial authorities for a review of its content and structure. Their recommendations are assessed and incorporated into the analysis.

Validation and Weighting

The analysis is sent to all provinces and territories for validation and weighting. Participating jurisdictions consult with industry to validate and weight the document, examining the blocks, tasks and sub-tasks of the analysis as follows:

BLOCKS	Each jurisdiction assigns a percentage of questions to each block for an examination that would cover the entire trade.
TASKS	Each jurisdiction assigns a percentage of exam questions to each task within a block.
SUB-TASKS	Each jurisdiction indicates, with a YES or NO, whether or not each sub-task is performed by skilled workers within the occupation in its jurisdiction.

The results of this exercise are submitted to the NOA development team who then analyzes the data and incorporates it into the document. The NOA provides the individual jurisdictional validation results as well as the national averages of all responses. The national averages for block and task weighting guide the Interprovincial Red Seal Examination plan for the trade.

This method for the validation of the NOA also identifies common core sub-tasks across Canada for the occupation. If at least 70% of the responding jurisdictions perform a sub-task, it shall be considered common core. Interprovincial Red Seal Examinations are based on the common core sub-tasks identified through this validation process.

Definitions for Validation and Weighting

YES	sub-task performed by qualified workers in the occupation in a specific jurisdiction
NO	sub-task not performed by qualified workers in the occupation in a specific jurisdiction
NV	analysis Not Validated by a province/territory
ND	trade Not Designated in a province/territory
NOT COMMON CORE (NCC)	sub-task, task or block performed by less than 70% of responding jurisdictions; these will not be tested by the Interprovincial Red Seal Examination for the trade
National Average %	average percentage of questions assigned to each block and task in Interprovincial Red Seal Examination for the trade

Provincial/Territorial Abbreviations

NL	Newfoundland and Labrador
NS	Nova Scotia
PE	Prince Edward Island
NB	New Brunswick
QC	Quebec
ON	Ontario
MB	Manitoba
SK	Saskatchewan
AB	Alberta
BC	British Columbia
NT	Northwest Territories
YT	Yukon Territory
NU	Nunavut

ANALYSIS

Safe working procedures and conditions, accident prevention, and the preservation of health are of primary importance to industry in Canada. These responsibilities are shared and require the joint efforts of government, employers and employees. It is imperative that all parties become aware of circumstances that may lead to injury or harm. Safe learning experiences and work environments can be created by controlling the variables and behaviours that may contribute to accidents or injury.

It is generally recognized that safety-conscious attitudes and work practices contribute to a healthy, safe and accident-free work environment.

It is imperative to apply and be familiar with the Occupational Health and Safety (OH&S) Acts and Workplace Hazardous Materials Information System (WHMIS) Regulations. As well, it is essential to determine workplace hazards and take measures to protect oneself, co-workers, the public and the environment.

Safety education is an integral part of training in all jurisdictions. As safety is an imperative part of all trades, it is assumed and therefore it is not included as a qualifier of any activities. However, the technical safety tasks and sub-tasks specific to the trade are included in this analysis.

SCOPE OF THE WELDER TRADE

"Welder" is this trade's official Red Seal occupational title approved by the Canadian Council of Directors of Apprenticeship (CCDA). This analysis covers tasks performed by welders whose occupational title has been identified by some provinces and territories of Canada under the following names:

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
Industrial Welder							✓						
Welder	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓
Welder Level 'A'										✓			

Welders permanently join pieces of metal by applying heat, using filler metal or fusion process. They join parts being manufactured, build structures and repair damaged or worn parts. They use various welding and cutting processes to join structural steel and cut metal in vessels, piping and other components. They also fabricate parts, tools, machines and equipment used in the construction and manufacturing industries.

Welders may specialize in certain types of welding such as custom fabrication, ship building and repair, aerospace, pressure vessel, pipeline, structural welding, and machinery and equipment repair.

They work for employers such as fabrication shops, steel and platform manufacturers, petrochemical refineries, mechanical contractors, transportation contractors (heavy machinery, aircraft, shipbuilding), and specialized welding shops. They can also be self-employed. Their work may be performed outdoors or indoors, and travel may be required to jobs in remote locations.

Welders require attributes such as good mechanical ability, manual dexterity, good vision, excellent eye-hand coordination, the ability to concentrate on detail work and work as part of a team. They also require the ability to work quickly and accurately, to visualize a finished product, to reason logically and to understand metallurgy.

Occupational hazards in this trade include: sparks, gases, hazardous fumes, burns, heavy lifting, exposure to ultra-violet light and infra-red rays, working at heights, in confined spaces and in trenches.

With experience, welders may advance to positions such as welding inspector, lead hand or welding supervisor. Some welders open their own repair shops or work as rig welders, contracting out their services.

This analysis recognizes similarities or overlaps with the work of industrial mechanics (millwright), sheet metal workers, steamfitters/pipefitters, metal fabricators (fitter), iron workers and boilermakers. With additional training, welders can transfer their skills to these related occupations.

OCCUPATIONAL OBSERVATIONS

The emphasis on safety and training in the day-to-day activities of welders is increasing.

Technological advances have resulted in more energy efficient and lighter welding equipment. Computers and microprocessors are now being incorporated into power sources, wire feeders and shop environments.

As tool manufacturers make use of alloys, the tools are becoming lighter, and for the most part safer, and more efficient. Tools are also being designed with a greater emphasis on ergonomics.

While the fundamentals of the processes have not changed, improved consumables such as welding wires and gases have increased productivity and quality of the end product.

Some layout skills, such as parallel line and radial line development, have been moved off the shop floor into the design office.

Welders work with a greater variety and volume of alloys. Knowledge of metallurgy has become more important.

Environmental concerns and awareness have increased.

Trends

There is an increase in safety awareness resulting in a higher demand for training and certification.

There is a greater emphasis on the use of personal protection equipment (PPE) due to a greater awareness of occupational hazards and increased regulations.

Documentation and reference materials are easier to access due to the increase in computer and Internet use.

The metric system is used more often than in the past.

Related Components

All components apply.

Tools and Equipment

See Appendix A.

Task 1 — Maintains and uses tools and equipment.

Context

Welders must use and maintain tools and equipment in order to safely and effectively perform the duties of their trade.

Sub-task 1.01 — Uses personal protective equipment (PPE) and safety equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

1.01.01	knowledge of types of PPE such as respirators, face shields, safety boots, ear protection, safety glasses and filter lenses
1.01.02	knowledge of safety equipment such as fire extinguishers, safety blankets and grinder guards
1.01.03	knowledge of location of safety equipment such as first aid kits and eye wash stations
1.01.04	knowledge of evacuation plans

1.01.05	knowledge of site safety requirements
1.01.06	ability to select PPE and safety equipment according to task and work environment
1.01.07	ability to maintain PPE and safety equipment
1.01.08	ability to store PPE and safety equipment
1.01.09	ability to recognize unsafe, worn, damaged and defective PPE and safety equipment and remove them from service
1.01.10	ability to recognize outdated PPE and safety equipment, and remove them from service

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Sub-task

1.02 **Maintains hand tools.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

1.02.01	knowledge of types of hand tools such as chipping hammers, wire brushes, files and clamps
1.02.02	knowledge of use of hand tools
1.02.03	ability to profile tools such as chipping hammers and chisels
1.02.04	ability to remove mushroom heads from chisels
1.02.05	ability to clean and store hand tools
1.02.06	ability to lubricate hand tools
1.02.07	ability to recognize worn, damaged and defective hand tools and remove from service

Sub-task

1.03 **Maintains power tools.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

1.03.01	knowledge of electric power tools such as grinders, drills and saws
1.03.02	knowledge of pneumatic power tools such as grinders and drills
1.03.03	knowledge of hydraulic power tools such as punches and shears
1.03.04	knowledge of rpm rating of power tool and attachments such as grinding discs and drill bits
1.03.05	knowledge of power tool attachments such as carbide blades, grinding discs and bits
1.03.06	ability to check fluids in hydraulic tools
1.03.07	ability to lubricate pneumatic tools
1.03.08	ability to check safety guards, cords, switches, connectors and hoses
1.03.09	ability to store power tools
1.03.10	ability to recognize worn, damaged and defective power tools and remove them from service

Sub-task

1.04 **Maintains stationary machinery.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

1.04.01	knowledge of types of stationary machinery such as shears, drill presses, band saws, press, hacksaws, brakes and ironworkers
1.04.02	knowledge of location of lubrication points
1.04.03	knowledge of types of lubricants such as grease and gear oil
1.04.04	knowledge of types of coolants
1.04.05	knowledge of standard operating procedures (SOP) for stationary machinery
1.04.06	ability to clean machinery
1.04.07	ability to lubricate machinery

1.04.08	ability to check and top up coolant reservoir on drill presses and saws
1.04.09	ability to "break in" new blades
1.04.10	ability to inspect dies and blades
1.04.11	ability to recognize worn, damaged and defective parts in stationary machinery and remove them from service
1.04.12	ability to lock out and tag out stationary machinery prior to servicing

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Sub-task
1.05 **Maintains layout and measuring tools.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

1.05.01	knowledge of types of layout tools such as squares, dividers, levels and trammel points
1.05.02	knowledge of types of measuring tools such as calipers, fillet gauges, steel gauges and measuring tapes
1.05.03	ability to check accuracy of layout and measuring tools
1.05.04	ability to recognize worn, damaged and defective layout and measuring tools and remove them from service
1.05.05	ability to store layout and measuring tools

Sub-task
1.06 **Maintains cutting and welding equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

1.06.01	knowledge of types of cutting equipment such as plasma and oxy-fuel
1.06.02	knowledge of types of welding equipment such as electrode holders, Gas Metal Arc Welding (GMAW) gun and Gas Tungsten Arc Welding (GTAW) torch
1.06.03	knowledge of components of cutting equipment such as regulators, tips and hoses

1.06.04	knowledge of regulator faults such as creeping regulators and damaged gauges
1.06.05	ability to detect leaks using soap test
1.06.06	ability to repair or replace hoses
1.06.07	ability to clean and store cutting and welding equipment
1.06.08	ability to change tips, diffusers and nozzles
1.06.09	ability to change plasma torch parts
1.06.10	ability to recognize worn, damaged and defective cutting and welding equipment and remove from service if repair is not practical

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Sub-task

1.07 **Uses access equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

1.07.01	knowledge of types and limitations of access equipment such as scissor lifts, scaffolding, ladders and man lifts
1.07.02	knowledge of training and certification requirements for using access equipment
1.07.03	knowledge of PPE required for access equipment
1.07.04	knowledge of jurisdictional safety regulations regarding use of access equipment
1.07.05	ability to select access equipment according to task
1.07.06	ability to inspect equipment and complete check list
1.07.07	ability to operate scissors lifts and man lifts
1.07.08	ability to recognize unsafe, worn, damaged and defective access equipment and remove them from service
1.07.09	ability to lock out and tag out faulty access equipment

Task 2 Organizes work.

Context In order to organize their work, welders must be able to use documents and drawings, recognize hazards on the work site, communicate effectively with others and plan their project tasks.

Sub-task 2.01 Maintains safe work environment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

2.01.01	knowledge of company and site safety policies and procedures
2.01.02	knowledge of workers' rights and responsibilities
2.01.03	knowledge of site-specific training such as equipment operation, working in confined spaces and use of fall protection systems
2.01.04	knowledge of housekeeping practices
2.01.05	knowledge of the location of on-site safety specifics such as first aid stations, eye wash stations, muster points and fire extinguishers
2.01.06	knowledge of disposal and recycling procedures
2.01.07	knowledge of site-specific emergency procedures such as reporting hazardous spills and evacuation procedures
2.01.08	knowledge of required ventilation for cutting and welding processes
2.01.09	ability to apply Workplace Hazardous Material Information System (WHMIS) procedures
2.01.10	ability to participate in site orientation and safety training
2.01.11	ability to locate on-site safety specifics such as first aid stations, eye wash stations, muster points and fire extinguishers
2.01.12	ability to install temporary safety protection such as barriers and caution flags according to company and site requirements
2.01.13	ability to inspect tools and equipment for damage and remove them from service
2.01.14	ability to report damaged machinery and accessories and remove them from service
2.01.15	ability to perform lock-out and tag-out according to company or site procedures

Sub-task

2.02 **Uses documentation and reference material.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

2.02.01	knowledge of types of documents such as quality assurance pages, work orders (job numbers), WHMIS materials, steel catalogues and confined space logs
2.02.02	knowledge of information on quality assurance pages such as hydrostatic tests and pre-shipping quality checks
2.02.03	knowledge of codes, regulations and certifications, and their limitations
2.02.04	ability to locate and read documentation
2.02.05	ability to complete work documents such as time sheets, hot work permits, machinery checklists and progress report sheets
2.02.06	ability to interpret welding procedure data sheets

Sub-task

2.03 **Interprets plans, drawings and specifications.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

2.03.01	knowledge of types of drawings such as detail, shop and fabrication drawings
2.03.02	knowledge of orthographic and isometric views
2.03.03	knowledge of types of specifications such as tolerances and material types
2.03.04	knowledge of imperial and metric systems of measurements
2.03.05	knowledge of general drafting principles such as drawing scales and project numbers
2.03.06	ability to interpret welding symbols and general notes
2.03.07	ability to convert between imperial and metric measurements
2.03.08	ability to interpret types of lines such as broken, hidden, centre and section lines
2.03.09	ability to visualize in three dimensions

2.03.10	ability to reference piece marks on drawings and specifications
2.03.11	ability to perform mathematical calculations
2.03.12	ability to interpret material list

Sub-task

2.04 **Communicates with others.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV	NV	NV

Supporting Knowledge & Abilities

2.04.01	knowledge of trade terminology
2.04.02	knowledge of International crane signals
2.04.03	knowledge of verbal and written communication
2.04.04	ability to use communication equipment such as two-way radios and cellular telephones
2.04.05	ability to communicate with supervisors
2.04.06	ability to consult with colleagues
2.04.07	ability to communicate with other tradespeople
2.04.08	ability to use confined space communication methods
2.04.09	ability to use hand signals
2.04.10	ability to mentor apprentices

Sub-task

2.05 **Compiles a list of materials and supplies.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

2.05.01	knowledge of project or task to be completed
2.05.02	knowledge of site conditions and restrictions
2.05.03	knowledge of available materials
2.05.04	ability to identify required materials and supplies according to plans and specifications

2.05.05	ability to perform mathematical calculations
2.05.06	ability to interpret site measurements and instructions
2.05.07	ability to verify material list
2.05.08	ability to check inventory and inform foreman, lead hand or storekeeper when materials are getting low

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Sub-task

2.06 **Plans project tasks.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

2.06.01	knowledge of task requirements such as space, labour, materials and supplies
2.06.02	knowledge of approximate time required to complete project task
2.06.03	knowledge of finished project restrictions such as the ability to remove project from the fabrication shop, crane limitations and transportation considerations
2.06.04	ability to determine and organize required equipment and material
2.06.05	ability to coordinate tasks with co-workers and other trades
2.06.06	ability to prepare work area
2.06.07	ability to determine sequence of tasks to be performed

Task 3 Performs quality control.

Context Welders use various methods of inspection, documentation, and confirmation of procedures and critical measurements to ensure quality. Quality assurance is important in this trade in order to produce quality products, save time and money, and ensure the required specifications are met.

Sub-task 3.01 **Performs inspection.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

3.01.01	knowledge of types of materials such as ferrous and non-ferrous
3.01.02	knowledge of job inspection requirements
3.01.03	knowledge of other inspections methods such as radiography and ultra-sonic examinations
3.01.04	knowledge of visual acceptance criteria
3.01.05	ability to select and use tools and equipment such as fillet gauges, calculators, measuring tapes, squares and straight edges
3.01.06	ability to refer to drawings during visual inspection
3.01.07	ability to detect surface imperfections such as welding spatter, gouges, stray arc strikes and sharp edges
3.01.08	ability to detect material defects such as twists, deformities, scratches and contamination
3.01.09	ability to detect fabrication defects such as heat distortion, improper fit-up and misalignment
3.01.10	ability to identify location of defect and recommend corrective measures
3.01.11	ability to detect welding defects such as under cut, porosity and discontinuities
3.01.12	ability to perform and interpret results of non-destructive testing such as liquid dye, magnetic particle examination and bend test
3.01.13	ability to perform and interpret results of destructive testing such as a bend test

Sub-task

3.02 **Marks materials and parts.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

3.02.01	knowledge of reasons for marking material and parts such as traceability, and identification for fabrication and erection
3.02.02	knowledge of mill certifications and heat numbers
3.02.03	knowledge of appropriate marking devices
3.02.04	knowledge of personalized weld identification methods such as initials and stamps
3.02.05	knowledge of company method of assigning piece marks
3.02.06	ability to refer to drawings to obtain piece marks
3.02.07	ability to transfer information from parent piece to off-cuts and crop pieces

Sub-task

3.03 **Verifies layout.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

3.03.01	knowledge of layout method used
3.03.02	knowledge of company method of checking layout
3.03.03	knowledge of crucial work points to be verified
3.03.04	ability to check measurements, angles, orientation and slopes
3.03.05	ability to select and use layout and measuring tools and equipment such as measuring tapes, dividers and protractors
3.03.06	ability to refer to drawings when verifying layout
3.03.07	ability to use jigs and templates to verify layout

Sub-task

3.04 **Verifies measurements.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

3.04.01	knowledge of measurements to be verified such as material, on-going dimensional measurements and final product measurements
3.04.02	knowledge of types of reference lines such as tangent lines, datum lines, centre lines and work points
3.04.03	ability to check raw materials upon delivery
3.04.04	ability to select and use tools and equipment such as measuring tapes, levels, squares, protractors and dividers
3.04.05	ability to check dimensions of components such as stiffeners, gussets and clips
3.04.06	ability to check dimension and gauge of hole patterns
3.04.07	ability to check square of material using corner-to-corner dimensions and triangulation (3-4-5) method

Sub-task

3.05 **Performs heat treatment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

3.05.01	knowledge of pre-heat, inter-pass and post-heat treatment requirements
3.05.02	knowledge of heat treatment methods such as annealing and tempering
3.05.03	knowledge of heat effects on material
3.05.04	knowledge of hardness scales such as Rockwell and Brinnell
3.05.05	knowledge of metallurgy of materials being heat treated
3.05.06	knowledge of cooling processes such as quenching and controlled cooling
3.05.07	ability to select and use tools and equipment to apply heat such as pre-heat ovens, insulation blankets and oxy-fuel torches

3.05.08	ability to apply heat
3.05.09	ability to select and use tools and equipment such as temperature sticks, pyrometer, thermometers and pre-heat monitoring equipment
3.05.10	ability to verify when heat has been adequately applied

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Sub-task

3.06 **Stores consumables.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

3.06.01	knowledge of welding consumables such as electrodes, welding wires and welding fluxes
3.06.02	knowledge of storing requirements for consumables
3.06.03	knowledge of cylinder storage requirements
3.06.04	knowledge of different types of storage containment such as cylinder racks and electrode ovens
3.06.05	ability to handle consumables such as welding wire spools and fluxes
3.06.06	ability to rotate stock (first in, first out)
3.06.07	ability to detect damaged products such as broken boxes of welding electrodes, chipped grinding disks and torn bags of fluxes
3.06.08	ability to identify outdated products
3.06.09	ability to store according to WHMIS or manufacturers' specifications
3.06.10	ability to identify consumables according to product labels and specifications
3.06.11	ability to label decanted substances

Task 4 — Performs routine trade activities.

Context

In an effort to promote and maintain a safe and healthy environment, welders must remain aware of all potential safety hazards.

With the wealth of available equipment, welders must be able to select appropriate power sources and follow manufacturers' specifications in the start-up and shut down in order to perform their jobs safely, efficiently and productively.

Sub-task
4.01 **Performs hazard assessments.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

4.01.01	knowledge of occupational health and safety (OH&S) requirements
4.01.02	knowledge of company safety requirements
4.01.03	knowledge of site safety requirements
4.01.04	knowledge of job tasks
4.01.05	knowledge of site, shop and building layout and dangerous areas
4.01.06	ability to identify potential hazards such as poor ventilation, chemical spills, electrical shocks, mechanical entanglement and explosions
4.01.07	ability to recognize welding equipment hazards such as sparks, flashbacks, fumes, poor ventilation and atomized gas
4.01.08	ability to coordinate activities with all worksite personnel to identify and limit potential hazards
4.01.09	ability to visually inspect worksite to identify hazards such as tripping hazards, falling objects and weather conditions
4.01.10	ability to handle and store hazardous materials such as pickling paste, acetone and aerosols

Sub-task

4.02 **Selects power source for welding processes.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

4.02.01	knowledge of welding processes such as SMAW, flux cored arc welding (FCAW), gas metal arc welding (GMAW), gas tungsten arc welding (GTAW), metal core arc welding (MCAW) and submerged arc welding (SAW)
4.02.02	knowledge of current types such as alternating current (AC), direct current (DC), constant current and constant voltage
4.02.03	knowledge of polarity
4.02.04	knowledge of duty cycle
4.02.05	knowledge of project and welding requirements
4.02.06	knowledge of process limitations of project to be welded such as heavy mill scale, painted surface and weather conditions
4.02.07	knowledge of primary power
4.02.08	knowledge of data sheets and code requirements
4.02.09	ability to identify power source according to welding process
4.02.10	ability to select stationary or portable power source according to location of project

Sub-task

4.03 **Performs equipment start-up and shut down.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

4.03.01	knowledge of manufacturers' specifications
4.03.02	knowledge of types of equipment such as oxy-fuel equipment, welding machines and access equipment
4.03.03	knowledge of equipment operation
4.03.04	knowledge of start-up and shut down procedures

4.03.05	knowledge of company policies
4.03.06	knowledge of certification requirements
4.03.07	ability to follow manufacturers' specifications

BLOCK B PREPARATION FOR WELDING PROCESSES

Trends

Safety and training are stringently enforced in the day-to-day activities of welders.

Quality control and its documentation have become common place.

Technological advances are being made in welding equipment, processes and consumables.

Computer-assisted design (CAD) is used more for the layout of components resulting in more complex designs. Some manual layout skills, such as parallel line and radial line development, have been moved off the shop floor into the design office.

Welders work with a greater variety and volume of alloys. Knowledge of metallurgy has become more important.

Related Components

All components apply.

Tools and Equipment

See Appendix A.

Task 5 Handles materials.

Context

Welders need to identify the material required and determine weight, shape and size before it is handled. They transfer the loads using rigging, hoisting and lifting equipment, and other material handling equipment such as forklifts, conveyor rollers, dollies and carts.

Lifts are planned to ensure that the proper rigging practices and safety factors are taken into account. Rigging equipment is used so that loads can be hoisted in a safe and secure manner.

Sub-task

5.01 **Obtains materials.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

5.01.01	knowledge of types of material such as beam, plates, bar stock, pipe and tubing
5.01.02	knowledge of types of components such as cut-to-size pieces, flanges and elbows
5.01.03	knowledge of grades of material
5.01.04	knowledge of storage location
5.01.05	ability to identify material required according to drawings and specifications
5.01.06	ability to select required amount of materials

Sub-task

5.02 **Verifies bill of materials.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

5.02.01	knowledge of types of material such as beam, plates, bar stock, pipe and tubing
5.02.02	knowledge of company method of assigning piece marks
5.02.03	ability to locate piece marks on material
5.02.04	ability to cross-reference piece marks with drawings and specifications
5.02.05	ability to locate piece marks after painting and galvanizing

Sub-task

5.03 **Organises materials.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

5.03.01	knowledge of types of material such as beam, plates, bar stock, pipe and tubing
5.03.02	knowledge of different carbon and alloy steels
5.03.03	knowledge of ferrous and non-ferrous metals
5.03.04	knowledge of job tasks and final product
5.03.05	knowledge of material required according to drawings and specifications
5.03.06	knowledge of sequential job tasks
5.03.07	ability to locate match marks on mating parts and lay down in the proper orientation
5.03.08	ability to determine if all required material is on site

Sub-task

5.04 **Uses rigging, hoisting and lifting equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

5.04.01	knowledge of material weight, centre of gravity, shape and dimensions
5.04.02	knowledge of types of rigging, hoisting and lifting equipment such as beam clamps, slings, plate clamps and wire ropes
5.04.03	knowledge of OH&S regulations and certification requirements for operating lifting devices such as overhead cranes and forklifts
5.04.04	knowledge of company policies and procedures
5.04.05	knowledge of working load limit
5.04.06	knowledge of lifting device capacity
5.04.07	knowledge of log books for overhead cranes and forklifts
5.04.08	knowledge of safety shut off buttons or switches
5.04.09	ability to perform and interpret hand signals

5.04.10	ability to select rigging, hoisting and lifting equipment
5.04.11	ability to transfer load using rigging, hoisting and lifting equipment
5.04.12	ability to place and use tag lines when required
5.04.13	ability to use dunnage and softeners to protect the rigging and load
5.04.14	ability to locate and interpret load charts
5.04.15	ability to perform, document and/or verify daily safety checks
5.04.16	ability to recognize worn, damaged and defective equipment and remove from service
5.04.17	ability to store rigging, hoisting and lifting equipment

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Sub-task

5.05 **Operates material handling equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

5.05.01	knowledge of material weight, centre of gravity, shape and dimensions
5.05.02	knowledge of types of material handling equipment such as forklifts, carts, conveyor rollers and dollies
5.05.03	knowledge of check list requirements
5.05.04	knowledge of refuelling procedures
5.05.05	knowledge of OH&S regulations and certification requirements for operating material handling equipment
5.05.06	knowledge of company policies and procedures
5.05.07	knowledge of safe working load
5.05.08	knowledge of safety shut off buttons or switches
5.05.09	ability to perform and interpret hand signals
5.05.10	ability to use controls
5.05.11	ability to locate and interpret load charts
5.05.12	ability to transfer load using material handling equipment
5.05.13	ability to use dunnage and softeners to protect the load
5.05.14	ability to recognize worn, damaged and defective material handling equipment
5.05.15	ability to perform, document and/or verify daily safety checks

Task 6 — Performs layout.

Context Welders lay out materials before any fabrication procedure such as cutting, drilling, bending and welding. It is important that the layout be done properly to prevent waste and ensure proper fit and accuracy.

Sub-task 6.01 — **Develops templates.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

6.01.01	knowledge of types of templates such as hole-punching templates, wrap-arounds, cutting templates and arc templates (sweeps)
6.01.02	knowledge of template materials such as wood, cardboard and metal
6.01.03	ability to lay out templates using manual drafting
6.01.04	ability to select and use tools to construct templates
6.01.05	ability to measure to required dimensions
6.01.06	ability to mark template with information such as part numbers, layout information and material required

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Sub-task 6.02 — **Transfers dimensions from drawings to materials.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

6.02.01	knowledge of mathematics as applicable to this trade
6.02.02	knowledge of imperial and metric systems of measurements
6.02.03	knowledge of reference points and dimensions that need to be transferred
6.02.04	ability to use measuring and layout tools such as combination squares, measuring tapes, plumb bobs and soapstones

6.02.05	ability to perform mathematical calculations
6.02.06	ability to lay out tangent lines and datum lines from drawings to material
6.02.07	ability to determine work points such as centre lines and quarter marks

Task 7 — Fabricates components.

Context Fabrication and preparation are critical steps for assembling welded components, often done in conjunction with other tradespersons. Fabrication includes all steps from the preparation of the weldment to the finishing stage. It is critical that pieces be fabricated within the tolerances of specifications.

Sub-task 7.01 — Prepares materials.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

7.01.01	knowledge of the final product
7.01.02	knowledge of the joint design
7.01.03	knowledge of joint preparation
7.01.04	knowledge of the material
7.01.05	knowledge of cleaning methods
7.01.06	ability to interpret weld symbols
7.01.07	ability to transfer measurements
7.01.08	ability to operate edge preparation equipment
7.01.09	ability to read drawings
7.01.10	ability to maintain tolerances

Sub-task

7.02 **Fits components.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

7.02.01	knowledge of assembly process
7.02.02	knowledge of starting point
7.02.03	knowledge of tolerances
7.02.04	knowledge of base metals and their characteristics
7.02.05	knowledge of types and specifications of fastening devices such as bolts and clips
7.02.06	knowledge of weld specifications and procedures
7.02.07	ability to select and use tools and equipment such as high-low gauges, wedges and clamps
7.02.08	ability to connect components together
7.02.09	ability to interpret the drawings according to specifications

Sub-task

7.03 **Tacks components.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

7.03.01	knowledge of types of base metals
7.03.02	knowledge of drawings and specifications
7.03.03	knowledge of jurisdictional rules, certification requirements and codes pertaining to tacking
7.03.04	knowledge of types and sizes of tacks
7.03.05	knowledge of sequence of tacks
7.03.06	knowledge of welding processes used for tacking such as SMAW and wire-feed processes
7.03.07	knowledge of welding processes to be used after tacking
7.03.08	knowledge of the impact of tack welding on the base metals

7.03.09	knowledge of various tacking methods such as bridge, penetrating and staggered
7.03.10	knowledge of the fundamentals of welding processes
7.03.11	ability to pre-heat base metals as required
7.03.12	ability to select and use welding tools and equipment
7.03.13	ability to incorporate tacks into final welds
7.03.14	ability to choose the welding process appropriate to the job
7.03.15	ability to recognize common defects in a tack such as cracks, porosity and slag inclusions
7.03.16	ability to remove tacks

Sub-task

7.04 **Assembles components.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

7.04.01	knowledge of assembly process
7.04.02	knowledge of starting point
7.04.03	knowledge of tolerances
7.04.04	knowledge of control of expansion and contraction such as staggered weld and back stepping
7.04.05	knowledge of inspection requirements for the components
7.04.06	knowledge of base metals and their characteristics
7.04.07	knowledge of weld specifications and procedures
7.04.08	knowledge of available equipment
7.04.09	knowledge of assembly constraints such as building size and equipment limitations
7.04.10	knowledge of types and specifications of fastening devices such as bolts and clips
7.04.11	ability to interpret plans and specifications
7.04.12	ability to define steps in the process
7.04.13	ability to visualize finished components prior to assembly
7.04.14	ability to select and use tools and equipment such as cranes, slings and alignment tools

7.04.15	ability to work within tolerance levels
7.04.16	ability to connect components together
7.04.17	ability to coordinate in conjunction with others

Sub-task

7.05 **Finishes final product.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

7.05.01	knowledge of final product according to specified requirements for job
7.05.02	knowledge of types of finishes
7.05.03	knowledge of finishing processes such as painting, galvanizing and pickling
7.05.04	ability to identify specifications for finishes
7.05.05	ability to ensure that welds are profiled as per specifications
7.05.06	ability to sort assemblies for specific finishes
7.05.07	ability to select and use tools and equipment such as grinders, wire wheels and buffers
7.05.08	ability to prepare weldments and other pieces by removing burrs and sharp corners
7.05.09	ability to chemically or mechanically clean weldments and other pieces, removing oils and undesirable materials
7.05.10	ability to fill and blend surface blemishes such as plate clamp gouges, stray arcs and miscellaneous defects
7.05.11	ability to ensure that weld spatter and slag are removed
7.05.12	ability to identify areas not to be finished
7.05.13	ability to protect tagging system to ensure traceability
7.05.14	ability to prepare weldments for galvanizing by providing air bleeds and drain holes

BLOCK C — CUTTING AND GOUGING

Trends

There is an increase in the use of automated water-cutting processes and equipment. Also becoming popular are the plasma water table process and the laser beam cutting process.

Related Components (include, but not limited to)

Boiler tubes and shields, boiler membranes, pipes, structural steels, heavy equipment components (buckets, tracks, blades, booms), ships, plate metal, angle iron, shaft, tanks, vessels.

Tools and Equipment

See Appendix A.

Task 8 — Uses mechanical and power tools for cutting and grinding.

Context

Welders must select the proper tools and blades/discs for the task. PPE such as safety glasses and shields, safety boots, ear protection and gloves must be worn at all times when cutting and grinding materials. Mechanical and power tools are typically used when the materials are being prepared for welding.

Sub-task 8.01 — **Selects cutting and grinding tools.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

8.01.01	knowledge of types of power cutting tools such as circular saws, beveling machines, reciprocating saws and band saws
8.01.02	knowledge of types of manual cutting tools such as hacksaws, files and snips
8.01.03	knowledge of grinding tools such as angle grinders, die grinders and bench grinders
8.01.04	knowledge of types and thicknesses of base metals
8.01.05	knowledge of types of cuts such as straight and bevel

8.01.06	ability to match the tool with the type of preparation desired such as bevels and angles
8.01.07	ability to match disc and blade composition with the base metals being cut or ground
8.01.08	ability to match grinder with the task such as sharpening tungsten, sharpening drill bits and removing burrs
8.01.09	ability to match cutting tools with the application such as cutting large pieces and cutting multiple pieces

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Sub-task

8.02 **Cuts using stationary band saws and power hacksaws.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

8.02.01	knowledge of material to be cut such as stainless steel, aluminum and carbon steel
8.02.02	knowledge of types of blades
8.02.03	knowledge of clearances, speed, direction and pitch of blade
8.02.04	knowledge of type of base metals being cut
8.02.05	ability to set feed speed to avoid blade damage
8.02.06	ability to change and tighten blade as required
8.02.07	ability to ensure adequate coolant by adjusting fluid control
8.02.08	ability to secure material to prevent damage to blade and material
8.02.09	ability to recognize hazards such as pinch points and accidental starting

Sub-task

8.03 **Cuts using mechanical and hydraulic shears.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

8.03.01	knowledge of material to be cut such as stainless steel, aluminum and carbon steel
8.03.02	knowledge of types of mechanical shears such as nibblers and ironworkers
8.03.03	knowledge of uses of mechanical and hydraulic shears such as cutting plates and angle iron, and punching holes
8.03.04	knowledge of limitations of mechanical and hydraulic shears such as type, thickness and size of material being cut
8.03.05	ability to secure material using equipment such as backstops, magnets, suction cups and locking dowels
8.03.06	ability to perform pre-operational check of equipment
8.03.07	ability to set backstops for multiple cuts
8.03.08	ability to recognize hazards such as ejected material and broken shears
8.03.09	ability to replace shear blades as required

Sub-task

8.04 **Cuts using hand tools.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

8.04.01	knowledge of types of hand tools such as hacksaws, files, snips, pipe cutters and chisels
8.04.02	knowledge of types and characteristics of files such as round, cross cut and half round
8.04.03	knowledge of characteristics of hacksaw blades such as offset and number of teeth per inch
8.04.04	knowledge of types and applications of aviator snips such as straight, and left- and right-handed
8.04.05	knowledge of characteristics of pipe cutters

8.04.06	ability to secure material
8.04.07	ability to tighten pipe cutters during cutting
8.04.08	ability to recognize hazards such as flying metal particles and sharp edges
8.04.09	ability to recognize dull and defective hand tools

Sub-task

8.05 **Cuts using grinders.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

8.05.01	knowledge of types of grinders such as die grinders and angle grinders
8.05.02	knowledge of types of pneumatic and electric grinders
8.05.03	knowledge of ratings and thicknesses of grinder discs
8.05.04	knowledge of air pressure supplied
8.05.05	knowledge of air pressure rating of pneumatic grinders
8.05.06	ability to select discs according to type and thickness of base metal
8.05.07	ability to secure material
8.05.08	ability to recognize hazards such as equipment running at high rpm, flying particles, sparks and damaged discs
8.05.09	ability to select disc according to grinder
8.05.10	ability to attach safety connection on air hoses
8.05.11	ability to hold grinder at appropriate angle for desired results
8.05.12	ability to back grind welds to sound metal
8.05.13	ability to use grinding procedures such as applying pressure, grinding in correct direction and using the edge to remove excess material

Sub-task

8.06 **Cuts using circular saws.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

8.06.01	knowledge of material to be cut such as stainless steel, aluminum and carbon steel
8.06.02	knowledge of types of circular saws such as cut-off saw and hand circular saw
8.06.03	knowledge of types of blades and discs such as composite, carbide and abrasive
8.06.04	knowledge of types of cuts such as straight and angle
8.06.05	ability to identify and replace blades and discs
8.06.06	ability to secure materials using tools such as clamps and vices
8.06.07	ability to recognize defective equipment and blades
8.06.08	ability to adjust cut-off saw for angle of cut
8.06.09	ability to use jigs, gauges and backstops during cutting operations
8.06.10	ability to recognize hazards such as equipment running at high rpm, flying particles, sparks and damaged blades and discs

Sub-task

8.07 **Cuts using reciprocating saws.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

8.07.01	knowledge of types of blades such as ferrous and non-ferrous metal cutting, and wood cutting
8.07.02	knowledge of lengths of blades
8.07.03	knowledge of characteristics of reciprocating blades such as offset, composition and number of teeth per inch
8.07.04	knowledge of material being cut
8.07.05	knowledge of tasks requiring the use of reciprocating saws such as removing fuel tanks and piping

8.07.06	ability to use cutting procedures such as ensuring shoe is tight to material and using two hands
8.07.07	ability to make straight cuts with saws
8.07.08	ability to recognize defective and dull blades

Task 9 — Uses oxy-fuel gas cutting process (OFC) for cutting and gouging.

Context

This task covers the selection and proper use of oxy-fuel equipment for cutting and gouging. Welders must be able to identify materials being cut and select the equipment to use. They must also be able to recognize hazards associated with this process.

This cutting process is fast, cost effective and versatile, requiring no external power source and results in quality cuts. The equipment is readily available and portable and is used primarily for cutting carbon steel.

Sub-task 9.01 — Selects oxy-fuel gas and equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

9.01.01	knowledge of types of oxy-fuel equipment such as torches, flashback arrestors, regulators, torch bodies and tips
9.01.02	knowledge of type and thickness of base metals
9.01.03	knowledge of construction and safety features of types of oxygen and fuel cylinders
9.01.04	knowledge of types of regulators such as low- and high-pressure, and single- and two-stage
9.01.05	knowledge of types of oxy-fuel gases such as acetylene, natural gas and propane
9.01.06	knowledge of automated oxy-fuel cutting equipment such as bevellers, track cutters and radiograph cutter
9.01.07	knowledge of base metals that can and cannot be cut using oxy-fuel cutting equipment
9.01.08	knowledge of limitations of oxy-fuel cutting and gouging

9.01.09	knowledge of gas characteristics such as thermal volume, temperature output and availability
9.01.10	ability to identify oxygen and fuel cylinders by shape, size and manufacturers' labels
9.01.11	ability to identify types and sizes of oxy-fuel equipment such as tips, manifolds, regulators, torches and hoses
9.01.12	ability to match regulator to delivery system and pressure rating
9.01.13	ability to match tip size to thickness of base metals
9.01.14	ability to match equipment to intended use
9.01.15	ability to identify left and right hand thread

Sub-task

9.02 **Sets up oxy-fuel equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

9.02.01	knowledge of types of oxy-fuel equipment such as torches, flashback arrestors, regulators, torch bodies and tips
9.02.02	knowledge of left- and right-hand threads for fuel gas and oxygen
9.02.03	knowledge of placement and securing of oxygen and fuel cylinders
9.02.04	knowledge of manufacturers' specifications, jurisdictional regulations and company policies
9.02.05	knowledge of types of tips and assembly techniques
9.02.06	knowledge of flashback and backfire
9.02.07	ability to place and secure oxygen and fuel cylinders
9.02.08	ability to clear cylinder valves by opening and closing valves
9.02.09	ability to install flashback arrestors at the regulator and torch
9.02.10	ability to install and set regulators on the cylinders
9.02.11	ability to connect hoses to regulators and torch
9.02.12	ability to set working pressures
9.02.13	ability to check equipment for leaks with non-petroleum solutions
9.02.14	ability to recognize damaged equipment such as leaking hoses on torches and creeping regulators

Sub-task

9.03 **Sets operating parameters for oxy-fuel equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

9.03.01	knowledge of type and thickness of base metals
9.03.02	knowledge of parameters such as pressure of oxy-fuel, volume and flame type
9.03.03	knowledge of types of regulators such as low- and high-pressure, and single- and two-stage
9.03.04	knowledge of safe working pressures
9.03.05	ability to match pressure to thickness of base metal
9.03.06	ability to adjust cylinder valves
9.03.07	ability to adjust regulator for operating pressure
9.03.08	ability to perform trial cut to check for cut defects

Sub-task

9.04 **Operates oxy-fuel equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

9.04.01	knowledge of type and thickness of base metals
9.04.02	knowledge of types of equipment such as cutting and gouging tips, torches and torch bodies
9.04.03	knowledge of types of flames such as carburizing, oxidizing and neutral
9.04.04	knowledge of safe working pressure of acetylene
9.04.05	knowledge of types and sizes of cutting and gouging tips
9.04.06	knowledge of travel speed of torch
9.04.07	knowledge of allowable tolerances
9.04.08	knowledge of metallurgy
9.04.09	ability to recognize hazards such as explosive gases, flammable materials and confined spaces

9.04.10	ability to light and adjust torch
9.04.11	ability to adjust torch valve for type of flame such as neutral, carburizing and oxidizing
9.04.12	ability to follow sequence of operations such as pre-heating material and initiating cut
9.04.13	ability to use tip cleaners to remove contaminants
9.04.14	ability to recognize and correct burnback and flashback
9.04.15	ability to apply oxy-fuel cutting techniques
9.04.16	ability to detect and correct defects in cut

Task 10 — Uses plasma arc cutting process (PAC) for cutting and gouging.

Context Welders use PAC process to cut ferrous and non-ferrous material; it provides cleaner cuts with minimal distortion in the material. The process requires high setup costs but as a result of increased production, it is cost-effective in the long term. Typically, this process requires less cleanup following the cutting operation.

Sub-task 10.01 — Selects PAC gas, equipment and consumables.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

10.01.01	knowledge of thickness of base metals
10.01.02	knowledge of power sources
10.01.03	knowledge of compressed air or gas supply
10.01.04	knowledge of air dryers and filters required on compressed air supply
10.01.05	knowledge of gases
10.01.06	knowledge of types of equipment such as manual and mechanical
10.01.07	knowledge of consumables such as tips, electrodes and cups
10.01.08	knowledge of fundamentals of PAC process
10.01.09	ability to match tips and cups to torch

10.01.10	ability to match gases such as nitrogen and compressed air to type and thickness of base metals
10.01.11	ability to match tips to thickness of base metals
10.01.12	ability to recognize hazards associated with gases used and produced w/pac

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Sub-task
10.02 **Sets up PAC equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

10.02.01	knowledge of manufacturers' recommendations and limitations
10.02.02	knowledge of equipment components such as tips, electrodes, guides and machines
10.02.03	ability to connect equipment to power source
10.02.04	ability to attach ground to work lead to ensure conductivity
10.02.05	ability to set up regulator
10.02.06	ability to visually check equipment and components

Sub-task
10.03 **Sets operating parameters for PAC.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

10.03.01	knowledge of thickness of base metals
10.03.02	knowledge of power source
10.03.03	knowledge of sizes of tip orifices and electrodes
10.03.04	knowledge of operating parameters such as pressure and amperage
10.03.05	knowledge of coolant level for liquid-cooled equipment
10.03.06	ability to set amperage according to base metals thickness

10.03.07	ability to set and check air or gas pressure
10.03.08	ability to perform trial cut to check for cut defects

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Sub-task
10.04 **Operates PAC equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

10.04.01	knowledge of thicknesses of base metals
10.04.02	knowledge of cutting techniques such as stand off and circle cutting
10.04.03	knowledge of types of tips, cups and shields
10.04.04	knowledge of travel speed
10.04.05	ability to apply PAC techniques such as initiating the arc and cut, starting at the right distance and using proper torch angle
10.04.06	ability to recognize defects in cuts
10.04.07	ability to recognize when tip needs replacement
10.04.08	ability to detect equipment malfunctions
10.04.09	ability to use jigs and guides during cutting operations

Task 11 Uses air carbon arc cutting (CAC-A) gouging process.

Context CAC-A is used for repairs, backgouging and removing welds. It can also be used for cutting metals on demolition projects. This process is a fast and efficient method of gouging or cutting base metals. Safety concerns of CAC-A processes are noise levels, fumes, fire, and ultraviolet and infra-red rays.

Sub-task 11.01 **Selects CAC-A equipment and consumables.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

11.01.01	knowledge of current types such as alternating current (AC), direct current (DC), constant current and constant voltage
11.01.02	knowledge of polarity
11.01.03	knowledge of duty cycle
11.01.04	knowledge of types and sizes of gouging torches
11.01.05	knowledge of amperage required for task
11.01.06	knowledge of types and thicknesses of base metals
11.01.07	knowledge of cable size
11.01.08	knowledge of air pressures and volumes required for task
11.01.09	knowledge of types and sizes of carbon-electrodes such as flat and round
11.01.10	ability to select size of carbon-electrode according to amount of material to be removed
11.01.11	ability to select carbon-electrodes according to type of base metals and task
11.01.12	ability to select gouging torches according to amperage and size of electrode

Sub-task

11.02 **Sets up CAC-A equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

11.02.01	knowledge of required air supply
11.02.02	knowledge of types and sizes of carbon-electrodes
11.02.03	knowledge of required ventilation
11.02.04	ability to connect equipment to power source and air supply
11.02.05	ability to place welding screens, fire blankets and signs
11.02.06	ability to connect torch/gouger to air lines and to power source
11.02.07	ability to attach work lead to ensure conductivity

Sub-task

11.03 **Sets operating parameters for CAC-A.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

11.03.01	knowledge of type and thickness of base metals
11.03.02	knowledge of parameters such as amperage and air pressure
11.03.03	knowledge of types and sizes of carbon-electrodes
11.03.04	knowledge of minimum air pressure and volume needed
11.03.05	knowledge of air pressure available
11.03.06	ability to read gauges to determine air pressure
11.03.07	ability to set amperage according to size of carbon-electrodes

Sub-task

11.04 **Operates CAC-A equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

11.04.01	knowledge of power source
11.04.02	knowledge of thicknesses of base metal
11.04.03	knowledge of carbon-electrodes
11.04.04	knowledge of depth and shape of gouge desired
11.04.05	knowledge of air orifices on gouger as related to direction of travel
11.04.06	ability to determine quality of cut
11.04.07	ability to adjust carbon-electrode length during use for proper gouge
11.04.08	ability to use operating techniques such as using angle of torch and removing the proper amount of metal
11.04.09	ability to detect and remove defects such as cracks, copper and carbon deposits, porosity and slag inclusions
11.04.10	ability to detect and correct equipment malfunctions

Trends

Surface tension transfer is a welding process that is more user-friendly and is becoming more popular due to the quality of the finished product and the cost efficiency of the process.

Plasma welding is used to weld thin gauge material without distortion. It is becoming more common in the food and medical industries.

Pulse welding has been in existence for many years but due to the decrease in the cost of power sources, is becoming more common.

Inverter welding machines are becoming more common because of cost efficiency, versatility, high amperage, increase duty cycle and portability.

Related Components

All components apply.

Tools and Equipment

See Appendix A.

Task 12 Welds using oxy-acetylene welding process.

Context

Oxy-acetylene welding is used when a component is worn or damaged, and cannot be replaced and a power supply is unavailable. Because of the greater heat input, this process causes distortion to the base metal that is being welded. It is less cost-effective than newer processes, which makes it less used than before.

Oxy-acetylene can also be used for brazing and braze-welding.

Another OAW process is hard facing (overlay) where surfaces are built up to bring them to their original thickness or to add extra material to increase abrasion resistance.

Sub-task

12.01 **Selects oxy-acetylene equipment and consumables.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	no	no	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

12.01.01	knowledge of weld position such as flat, horizontal, vertical and overhead
12.01.02	knowledge of type and thickness of base metals
12.01.03	knowledge of types of regulators such as low- and high-pressure, and single- and two-stage
12.01.04	knowledge of fundamentals of oxy-acetylene welding processes
12.01.05	knowledge of types of flames such as carburizing, oxidizing and neutral
12.01.06	knowledge of safe working pressure of acetylene
12.01.07	knowledge of working pressure according to thickness of metals
12.01.08	knowledge of types of torches such as combination, welding and cutting
12.01.09	knowledge of consumable rods and fluxes for welding, brazing and hard surfacing
12.01.10	knowledge of manufacturers' specifications, jurisdictional regulations and company policies
12.01.11	knowledge of tip sizes
12.01.12	ability to select regulators according to pressure requirement
12.01.13	ability to match tip size to base metal thickness
12.01.14	ability to match filler rod to base metal

Sub-task

12.02 **Sets operating parameters for oxy-acetylene process.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	no	no	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

12.02.01	knowledge of weld position such as flat, horizontal, vertical and overhead
12.02.02	knowledge of rod diameters and tip sizes
12.02.03	knowledge of type and thickness of base metals
12.02.04	knowledge of the use of flashback arrestors

12.02.05	knowledge of types of flame such as carburizing, oxidizing and neutral
12.02.06	ability to reference manufacturers' instructions and specifications
12.02.07	ability to adjust operating pressures
12.02.08	ability to adjust flame

Sub-task

12.03 **Operates oxy-acetylene equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	no	no	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

12.03.01	knowledge of weld position such as flat, horizontal, vertical and overhead
12.03.02	knowledge of rod diameters and tip sizes
12.03.03	knowledge of overlay and hard surfacing applications and techniques
12.03.04	knowledge of type and thickness of base metals
12.03.05	knowledge of properties of gases
12.03.06	knowledge of pre-heating requirements for base metals
12.03.07	knowledge of oxy-fuel welding techniques
12.03.08	knowledge of coated rods, powdered flux and paste flux
12.03.09	ability to refer to manufacturers' instructions and specifications
12.03.10	ability to manipulate torches such as maintaining tip stand-off and changing or maintaining tip angles
12.03.11	ability to adjust gas flow at torch
12.03.12	ability to adjust flame type
12.03.13	ability to maintain constant puddle by using appropriate travel speed
12.03.14	ability to use welding techniques such as backhand and forehand techniques
12.03.15	ability to light and extinguish torch
12.03.16	ability to recognize potential hazards such as flashback and backfire
12.03.17	ability to recognize when tips require cleaning

Task 13 Welds using shielded metal arc welding process (SMAW).

Context

Shielded metal arc welding is a commonly used process for joining most ferrous and non-ferrous metals. Even though it is one of the slowest of the electrical processes, it is readily available, easily accessible, and very reliable.

Another commonly used SMAW process is hard facing (overlay) where surfaces are built up to bring them to their original thickness or to add extra material to increase abrasion resistance.

Sub-task

13.01 **Selects SMAW equipment and consumables.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

13.01.01	knowledge of fundamentals of SMAW
13.01.02	knowledge of weld position such as flat, horizontal, vertical and overhead
13.01.03	knowledge of types of welding power sources such as constant current AC and DC
13.01.04	knowledge of types of equipment components such as electrode holders , work leads cables and ground clamps
13.01.05	knowledge of duty cycle
13.01.06	knowledge of cable size and length
13.01.07	knowledge of polarity such as AC and DC electrode negative and DC electrode positive
13.01.08	knowledge of type and thickness of base metals
13.01.09	knowledge of storage requirements for consumable electrodes
13.01.10	knowledge of electrode classifications such as tensile strength, position and composition
13.01.11	knowledge of metric and imperial electrode designations
13.01.12	ability to select welding machines such as inverters, rectifiers and generators, according to the task
13.01.13	ability to select electrodes according to specifications

Sub-task

13.02 **Sets up SMAW equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

13.02.01	knowledge of base metals
13.02.02	knowledge of manufacturers' instructions and specifications
13.02.03	knowledge of refuelling and general maintenance checks (oil, water, etc.) of engine-driven power sources as per procedures
13.02.04	ability to connect cables, electrode holders (stingers) and ground clamps to appropriate terminal
13.02.05	ability to start fuel-powered generators
13.02.06	ability to connect equipment to power source

Sub-task

13.03 **Sets operating parameters for SMAW.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

13.03.01	knowledge of weld position such as flat, horizontal, vertical and overhead
13.03.02	knowledge of type and thickness of base metals
13.03.03	knowledge of welding procedure data sheet
13.03.04	knowledge of travel speed and heat inputs
13.03.05	knowledge of amperage requirements for electrodes
13.03.06	knowledge of amperage requirements for positions
13.03.07	knowledge of diameters of electrodes
13.03.08	knowledge of manufacturers' information and specifications
13.03.09	knowledge of polarity
13.03.10	ability to read and adjust amperage controls
13.03.11	ability to verify set up by running test weld specimen

Sub-task

13.04 **Operates SMAW equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

13.04.01	knowledge of weld position such as flat, horizontal, vertical and overhead
13.04.02	knowledge of overlay and hard surfacing applications and techniques
13.04.03	knowledge of type and thickness of base metals
13.04.04	knowledge of pre-heating requirements for base metals
13.04.05	knowledge of storage requirements for consumable electrodes
13.04.06	knowledge of manufacturers' instructions and specifications
13.04.07	knowledge of types of welding electrodes such as rutile, cellulose, low-hydrogen and iron-powder
13.04.08	knowledge of weld defects
13.04.09	ability to manipulate electrode angle using methods such as drag, weave or whip
13.04.10	ability to maintain constant puddle by using appropriate travel speed
13.04.11	ability to stop and properly re-start arc to avoid welding defects

Task 14 — Welds using flux cored arc welding process (FCAW), metal core arc welding process (MCAW) and gas metal arc welding process (GMAW).

Context

Flux cored arc welding is a semi-automatic process that uses tubular wire with a granular flux, which may require shielding. It uses a constant voltage (CV) power source and a wire feeder that supplies continuous wire. FCAW is widely used in production shops because of its high productivity, low operating cost and high efficiency. MCAW is used for a fast deposit of weld on low carbon steel in production shops.

The gas metal arc welding process, also known as MIG, uses solid wire for welding metals such as aluminium, sheet metal, structural steel and piping systems. It has a low distortion rate, a high production rate and requires a small amount of cleaning.

An often used FCAW and GMAW process is hard facing (overlay) where surfaces are built up to bring them to their original thickness or to add extra material to increase abrasion resistance.

Sub-task 14.01 — **Selects FCAW, MCAW and GMAW gas, equipment and consumables.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

14.01.01	knowledge of fundamentals of FCAW, MCAW and GMAW welding
14.01.02	knowledge of weld position such as flat, horizontal, vertical and overhead
14.01.03	knowledge of type and thickness of base metals
14.01.04	knowledge of different types of transfer such as pulse, globular, spray and short circuit
14.01.05	knowledge of automatic and semi-automatic processes
14.01.06	knowledge of types of regulators, cylinders and hoses
14.01.07	knowledge of shielding gases such as CO_2, argon and argon-mix gases
14.01.08	knowledge of equipment such as guns, nozzles, contact tips, wire feeders, drive rolls, gas diffusers and liners
14.01.09	knowledge of types of wires such as solid and tubular
14.01.10	knowledge of CV requirements
14.01.11	knowledge of duty cycle

14.01.12	knowledge of polarity
14.01.13	knowledge of power source
14.01.14	knowledge of cable size
14.01.15	ability to select drive rolls required for diameter and type of wire
14.01.16	ability to select liners according to diameter and type of wire
14.01.17	ability to interpret datasheets specifications

Sub-task

14.02 **Sets up FCAW, MCAW and GMAW equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

14.02.01	knowledge of automatic and semi-automatic processes
14.02.02	knowledge of types of cylinders, regulators and hoses
14.02.03	knowledge of gases such as CO_2, argon and argon-mix gases
14.02.04	knowledge of equipment such as guns, nozzles, contact tips, wire feeders, drive rolls, gas diffusers and liners
14.02.05	knowledge of types of wires such as solid and tubular
14.02.06	knowledge of CV requirements
14.02.07	knowledge of duty cycle
14.02.08	knowledge of polarity
14.02.09	knowledge of power source
14.02.10	knowledge of cable size
14.02.11	ability to select and use tools and equipment such as wrenches, wire cutters and MIG pliers
14.02.12	ability to change components according to task
14.02.13	ability to connect cables to power source
14.02.14	ability to connect gas line to regulator
14.02.15	ability to connect wire feeder to cables
14.02.16	ability to install gun components such as gas diffusers, contact tips and nozzles
14.02.17	ability to install roll of wire in wire feeder
14.02.18	ability to feed wire through to tip
14.02.19	ability to set wire drive roll tension

14.02.20	ability to attach ground to base metal for conductivity
14.02.21	ability to test for leaks
14.02.22	ability to interpret computer program readouts

Sub-task

14.03 **Sets operating parameters for FCAW, MCAW and GMAW**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

14.03.01	knowledge of type and thickness of base metals
14.03.02	knowledge of filler metals
14.03.03	knowledge of welding procedure data sheet
14.03.04	knowledge of FCAW and GMAW transfer modes such as globular and spray
14.03.05	knowledge of GMAW-specific transfer modes such as short-circuit and pulse
14.03.06	knowledge of gases such as CO_2, argon and argon-mix gases
14.03.07	knowledge of CV requirements
14.03.08	knowledge of polarity
14.03.09	knowledge of wire stick-out
14.03.10	ability to match parameters to position and base metal thickness
14.03.11	ability to set gas flow rate
14.03.12	ability to set voltage
14.03.13	ability to set wire speed
14.03.14	ability to adjust drive roll tension
14.03.15	ability to adjust push and pull feeder gun for aluminium use in GMAW process
14.03.16	ability to select GMAW computer program
14.03.17	ability to verify set up by running test welds

Sub-task

14.04 **Operates FCAW, MCAW and GMAW equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

14.04.01	knowledge of weld position such as flat, horizontal, vertical and overhead
14.04.02	knowledge of overlay and hard surfacing applications and techniques
14.04.03	knowledge of type and thickness of base metals
14.04.04	knowledge of filler metals
14.04.05	knowledge of FCAW and GMAW transfer modes such as globular and spray
14.04.06	knowledge of GMAW-specific transfer modes such as short-circuit and pulse
14.04.07	knowledge of properties of gases such as CO_2, argon and argon-mix gases
14.04.08	knowledge of CV requirements
14.04.09	knowledge of polarity
14.04.10	ability to maintain wire stick-out
14.04.11	ability to interpret welding procedure data sheet
14.04.12	ability to troubleshoot FCAW, MCAW and GMAW process
14.04.13	ability to match speed and direction (push or pull) of travel to required weld size according to base metals
14.04.14	ability to manipulate gun
14.04.15	ability to detect and correct weld fault

Task 15 Welds using gas tungsten arc welding process (GTAW).

Context Gas tungsten arc welding processes (also known as tungsten inert gas—TIG) use a non-consumable electrode (tungsten). It provides the highest quality welds and is the cleanest process. It welds most ferrous and non-ferrous metals and thicknesses. It requires the most dexterity of all welding processes.

Sub-task
15.01 **Selects GTAW gas, equipment and consumables.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

15.01.01	knowledge of fundamentals of GTAW process
15.01.02	knowledge of weld position such as flat, horizontal, vertical and overhead
15.01.03	knowledge of type and thickness of base metals
15.01.04	knowledge of automated gas tungsten arc welding equipment
15.01.05	knowledge of shielding gases such as argon and helium
15.01.06	knowledge of regulators and flow meters
15.01.07	knowledge of equipment such as tungsten electrodes, gas lenses, collets and collet bodies
15.01.08	knowledge of filler rods
15.01.09	knowledge of power sources
15.01.10	knowledge of current types and polarity
15.01.11	knowledge of types of torches such as air cooled and liquid cooled
15.01.12	knowledge of amperage controls such as foot pedal, thumb control and remote
15.01.13	knowledge of duty cycle
15.01.14	knowledge of back purge and damming methods
15.01.15	ability to select tungsten according to colour and base metal
15.01.16	ability to interpret weld procedure data sheets specifications

Sub-task

15.02 **Sets up GTAW equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

15.02.01	knowledge of base metals
15.02.02	knowledge of base metal thickness
15.02.03	knowledge of polarity
15.02.04	knowledge of the uses of remote amperage control
15.02.05	knowledge of when to use purge
15.02.06	knowledge of the use of high frequency, variable frequency and balance control
15.02.07	knowledge of air- and liquid-cooled torches
15.02.08	ability to select and use wrenches
15.02.09	ability to connect torches and components
15.02.10	ability to connect and adjust regulators and flow meters to cylinders
15.02.11	ability to connect purge to work, as required
15.02.12	ability to prepare tungsten by sharpening or balling it to desired tip shape

Sub-task

15.03 **Sets operating parameters for GTAW.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

15.03.01	knowledge of weld position such as flat, horizontal, vertical and overhead
15.03.02	knowledge of type and thickness of base metals
15.03.03	knowledge of water-cooled torch operation
15.03.04	knowledge of welding procedure data sheet
15.03.05	knowledge of AC high frequency, variable frequency, balance control and DC electrode negative (DCEN)
15.03.06	knowledge of types of tungsten
15.03.07	knowledge of pre- and post-flow purge

15.03.08	knowledge of AC balance and wave forms
15.03.09	ability to set amperage
15.03.10	ability to set and verify flow rates
15.03.11	ability to adjust tungsten stick-out
15.03.12	ability to adjust purge requirements

Sub-task

15.04 **Operates GTAW equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

15.04.01	knowledge of weld position such as flat, horizontal, vertical and overhead
15.04.02	knowledge of type and thickness of base metals
15.04.03	knowledge of filler rods
15.04.04	knowledge of pre- and post-flow purge
15.04.05	knowledge of AC balance and wave forms
15.04.06	knowledge of pulse techniques
15.04.07	knowledge of properties of gases
15.04.08	ability to use torches techniques for GTAW in all positions
15.04.09	ability to set amperage with and without remote amperage controls
15.04.10	ability to match feed and travel speed
15.04.11	ability to detect and correct weld faults
15.04.12	ability to detect equipment malfunctions

Task 16 Welds using submerged arc welding process (SAW).

Context

Submerged arc welding is a fully-automatic process with the highest production rate. The most difficult part of this process is setting up the equipment. It is the only wire feed process that uses AC and DC currents.

This process is mostly used on large scale productions, such as pressure vessels, tanks, bridges and ship construction. SAW welds most metal 3/16 inch thick and more.

Sub-task 16.01 **Selects SAW equipment and consumables.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

16.01.01	knowledge of fundamentals of SAW processes
16.01.02	knowledge of weld position such as flat, horizontal, vertical and overhead
16.01.03	knowledge of type and thickness of base metals
16.01.04	knowledge of consumables such as fluxes and wires
16.01.05	knowledge of equipment supports such as booms and tracks
16.01.06	knowledge of SAW equipment such as drive rolls, contact tips and barrels
16.01.07	knowledge of sub-arc tractors
16.01.08	knowledge of flux recovery systems
16.01.09	knowledge of uses of cables and ground clamps
16.01.10	knowledge of power sources such as AC and DC
16.01.11	knowledge of control panels
16.01.12	knowledge of duty cycle
16.01.13	ability to follow manufacturers' specifications
16.01.14	ability to interpret weld procedure data sheet specifications

Sub-task

16.02 **Sets up SAW equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

16.02.01	knowledge of weld position such as flat, horizontal, vertical and overhead
16.02.02	knowledge of power sources such as AC and DC
16.02.03	knowledge of type and thickness of base metals
16.02.04	knowledge of manufacturers' specifications and limitations
16.02.05	knowledge of welding cable sizes
16.02.06	ability to interpret data sheet specifications
16.02.07	ability to select and use tools and equipment such as bolt cutters, overhead cranes, tracks and vessel rolls
16.02.08	ability to place and secure weldments
16.02.09	ability to connect cables and ground clamps to power source
16.02.10	ability to change components according to task
16.02.11	ability to install roll of wire
16.02.12	ability to feed wire through barrel and contact tip
16.02.13	ability to set wire drive roll tension
16.02.14	ability to fill flux hopper
16.02.15	ability to set angle on barrel depending on task
16.02.16	ability to connect ground to base metal for conductivity

Sub-task

16.03 **Sets operating parameters for SAW.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

16.03.01	knowledge of weld position such as flat, horizontal, vertical and overhead
16.03.02	knowledge of type and thickness of base metals
16.03.03	knowledge of welding procedure data sheet

16.03.04 knowledge of power sources such as AC and DC

16.03.05 ability to adjust voltage and wire speeds according to diameter of wire

16.03.06 ability to set travel speed

16.03.07 ability to set wire stick-out

16.03.08 ability to read gauges and adjust dials

16.03.09 ability to verify set up by running test welds specimen

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Sub-task

16.04 **Operates SAW equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

16.04.01 knowledge of type and thickness of base metals

16.04.02 knowledge of power sources such as AC and DC

16.04.03 knowledge of welding data sheet

16.04.04 knowledge of manufacturers' specifications

16.04.05 ability to adjust travel speed (inches per minute)

16.04.06 ability to adjust amperage during operation

16.04.07 ability to adjust wire stick-out

16.04.08 ability to remove slag, and recognize and correct weld defects

16.04.09 ability to recover and filter flux

Task 17 Welds using other processes.

Context

Welders use stud welding to secure studs and pins to metal surfaces to attach materials such as insulation and refractories.

They use resistance welding (RW) processes to join sheet metal pieces in the automotive and sheet metal industries.

Automated processes are used in a variety of high tech industries to produce high quality and cost effective welds.

Sub-task

17.01 **Uses stud welding process (SW).**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

17.01.01	knowledge of power sources
17.01.02	knowledge of manufacturers' data sheets
17.01.03	knowledge of types and sizes of studs and pins
17.01.04	knowledge of operation of stud guns
17.01.05	knowledge of types and sizes of ferrules
17.01.06	knowledge of applications of stud welding such as duct work, boilers and bridges
17.01.07	knowledge of types and thicknesses of base metals
17.01.08	ability to match consumables to welding process
17.01.09	ability to set up stud welding machine
17.01.10	ability to test equipment set up
17.01.11	ability to adjust machine as required
17.01.12	ability to level and square gun to base metal
17.01.13	ability to recognize sound weld
17.01.14	ability to detect equipment malfunctions

Sub-task

17.02 **Uses resistance welding (RW) processes (Spot (RSW) and Seam (RSEW)).**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	no	yes	yes	no	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

17.02.01	knowledge of types and thicknesses of base metals
17.02.02	knowledge of power sources
17.02.03	knowledge of operation of RW equipment according to manufacturers' specifications
17.02.04	knowledge of types of RW equipment such as manual (spot) and semi-automatic (seam)

17.02.05	knowledge of tips and wheels
17.02.06	ability to operate RW equipment
17.02.07	ability to change tips and wheels
17.02.08	ability to check for sound welds

Sub-task
17.03 **Operates automated welding equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	no	yes	yes	no	yes	yes	NV	NV	NV

Supporting Knowledge & Abilities

17.03.01	knowledge of power sources
17.03.02	knowledge of applications for automated equipment such as sanitary piping, pipeline construction and the pharmaceutical industry
17.03.03	knowledge of automated equipment such as orbital welder, laser welder and electron beam welder
17.03.04	knowledge of computer software programs
17.03.05	ability to select gas and consumables according to task
17.03.06	ability to select computer software program for the task
17.03.07	ability to backpurge piping
17.03.08	ability to recognize proper joint preparation
17.03.09	ability to change components such as tips
17.03.10	ability to recognize sound welds
17.03.11	ability to recognize equipment malfunction
17.03.12	ability to adjust arc voltage control and amperage

APPENDICES

APPENDIX A TOOLS AND EQUIPMENT

Hand Tools

adjustable wrenches (various sizes)
broom
brushes (bristle brushes, wire brushes, paint brushes)
chalk line
chisels (cold, bullpin)
clamps (C,)
cylinder carts
cylinder cradles
dollies
files (flat, half-round, rat-tail, bastard)
flashlight
friction lighter
funnels
hacksaw
hammers (chipping, ball peen, claw, sledge,)
hand shears
hex wrenches (metric and imperial)
hydraulic jack
knives
locking pliers
magnets
metal markers
oil can
pails (plastic and metal)
pipe cutters
pipe wrap
pipe wrenches
pliers (needle nose, MIG, slip joint)
pry bars
punches (center, prick)
rollers
scrapers (various sizes)
screwdrivers (flat, Phillips, Robertson; Torx, Allen Drivers; various sizes)
shovels (flat mouth)
snips, aviator (left-, right-handed, straight)
soapstone markers
socket sets (metric and imperial)
soldering iron
stamping tools
tip cleaners
tool boxes
vices (bench vice, chain vice)
water hose
wrench sets (open and closed ends; both metric and imperial)

Layout, Measuring and Testing Tools

ammeter
calculator
callipers
combination squares
depth gauge
feeler gauges
fillet gauges
laser level
micrometer
plum bob
pyrometer
scribers
spirit level
squares
straight edges
tape measure
temperature sticks
torpedo level
vernier calipers

Power Tools and Equipment

air hose and nozzle
band saw
buffers
chop saw (cut-off saw)
circular saw
coil heating equipment
communication devices (two-way radios, cell phones)
compressors
drills (portable, hammer, electric, mag)
extension cords
grinders (die, bench, pedestal, angle)
hoses
hydraulic press brake
hydraulic shears
hydrostatic equipment
impact wrenches (electric or pneumatic)
nibblers
pipe bevelling machines
pipe cutters
pneumatic equipment
portable heaters
power hacksaw
power vice
propane torch (tiger torch)
reamer (hand held or mounted on power threader)
reciprocating saw
rosebud
routers
sanders
vacuum (wet/dry)
winches

Rigging, Hoisting and Lifting Equipment

cable clamps
chain block hoist
chains
chokers
come-alongs (cable or chain)
cranes (overhead, gantry-type, monorail, boom)
dunnage (blocking)
forklift
jackstands
overhead hoist
portable boom
rope
shackles
slings
softeners
spreader bars
tuggers

Access Equipment

elevated work platform
ladders
scaffolding
scissor lift

Personal Protective Equipment and Safety Equipment

air hoods
air/gas monitoring device
aprons
body harness / lanyards
boots
coveralls
ear-plugs and ear muffs
face shields
fire blankets
fire extinguishers
fire hoses
gloves
goggles
hard hat
masks (particle, vapour)
respirators
safety glasses
welding shield

Cutting, Gouging and Welding equipment

arc welder
cable connectors
electrode holders
electrode ovens
ground clamp
oxy-fuel cutting and welding equipment
plasma console
torches (TIG, plasma, oxy-fuel, arc-air)
welding cable
welding guns
wire feeders

APPENDIX B GLOSSARY

ammeter	meter used to measure amperage within an electrical circuit
arc welding	process that uses an electric arc to produce a molten puddle to join metals
atomized gas	a gas formed when a liquid is dispersed as a stream of droplets
barrel	extension for the sub-arc tip; a straight torch
connector (female/male)	connectors used at the end of welding cables or torch hoses to connect cables or hoses together
consumables	materials that are consumed in the course of welding and cutting operations
contact tip	tip found at the end of a welding gun in which electricity is transferred from the gun to the consumable wire before the wire enters the weld zone
decant	to pour (a liquid) from one container into another
drive rolls	in wire feed, equipment that comes in various sizes and is used to drive wire through liner to gun contact tip
dunnage	blocking or cribbing used to support a load
electrode (rod) ovens	ovens that are maintained at a certain temperature to keep electrodes stabilized and dry
electrodes	metal filler rods of varying lengths and thicknesses which may be coated with flux or other materials to aid in welding or cutting operations
filler wire	consumable melted during the welding process that becomes part of the weldment
flashback arrestor	type of equipment that prevents possible explosions due to ignition of gases in the hoses of oxy-fuel or air/fuel equipment. New torches may have built-in flashback arrestor, eliminating the need for external
flashback/ burnback	condition in which torch flame rapidly burns back into the torch tip making a pronounced popping sound and causing the gases to rapidly re-ignite; this is usually caused by excessively dirty torch tip or low gas pressures
flow meter	meter used in conjunction with a regulator to measure the volume of gases used in welding processes
flux	a chemical cleaning agent which facilitates soldering, brazing, and welding by removing oxidation from the metals to be joined
gas diffusers	in gas tungsten arc welding, a collet body holder that diffuses the gas and grips the tungsten

ground clamp	clamp fastened to the end of a welding cable that is then fastened onto a workpiece to allow for a completed welding circuit
guns	part of certain types of welding equipment that is actually held in the hand and is used to control the filler wire
heat treatment	any application of heat to metal assemblies for the purpose of bending, stress relieving, preheating, hardening, or tempering
inverter power sources	power sources designed to operate on a high cycle to provide high amperage in a smaller unit
magnetic particle examination	test involving magnetic yokes and iron filings to determine the existence of defects or cracks in the surface of the welds
metallurgy	branch of science that involves the chemical analysis of metals and alloys
nozzle	ceramic or metal cup located at the end of a welding gun or TIG torch which gases flow through before travelling to work surface
pickling paste	acidic compound applied to the surface of stainless steel to replenish the oxide layer, returning the steel to its original condition
postheating	heating assemblies after final welds are complete to remove stresses, often involving wrapping the assembly in fire-retardant materials to allow even distribution of heat
preheating	heating metals to a desired temperature to aid in the welding process
puddle	pool or puddle of molten material that forms the bond between pieces that are being welded
regulator	piece of equipment that regulates the flow and/or pressure of gases through a hose
resistance welding (RW)	type of welding that requires the passage of current through the material (usually when bonding sheet materials) at a precise location and which depends on the melting together of the two pieces at that point
slag	impure or oxidized material produced during some welding operations
stick-out	amount of filler wire, tungsten, or other material protruding from the gun's contact tip or collet of the equipment
surface tension transfer	a patented controlled short-circuit transfer GMAW process to make single-sided root welds on pipe
transformer rectifiers	type of welding power source that brings in AC power and rectifies it to DC through the use of a diode

APPENDIX C

ACRONYMS

AC	alternating current
CAC-A	air carbon arc cutting
CAD	computer assisted design
CC	constant current
CO_2	carbon dioxide
CV	constant voltage
DC	direct current
FCAW	flux cored arc welding
GMAW (MIG)	gas metal arc welding
GTAW (TIG)	gas tungsten arc welding
MCAW	Metal core arc welding
MIG	metal inert gas
OFC	oxy-fuel gas cutting
OH&S	Occupational Health and Safety
PAC	plasma arc cutting
PPE	personal protective equipment
RSEW	seam welding
RSW	spot welding
RW	resistance welding
SAW	submerged arc welding
SOP	standard operating procedures
SW	stud welding
TIG	tungsten inert gas
WHMIS	Workplace Hazardous Materials Information System

APPENDIX D BLOCK AND TASK WEIGHTING

BLOCK A OCCUPATIONAL SKILLS

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	20	10	15	14	25	10	10	25	25	10	NV	NV	NV	17%

Task 1 Maintains and uses tools and equipment.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	30	30	20	18	20	10	25	30	40	10	NV	NV	NV	23%

Task 2 Organizes work.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	10	20	20	23	20	40	20	32	35	35	NV	NV	NV	25%

Task 3 Performs quality control.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	10	25	40	23	35	40	30	18	10	35	NV	NV	NV	27%

Task 4 Performs routine trade activities.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	50	25	20	36	25	10	25	20	15	20	NV	NV	NV	25%

BLOCK B PREPARATION FOR WELDING PROCESSES

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	10	25	15	22	20	10	40	21	25	15	NV	NV	NV	20%

Task 5 Handles materials.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	20	20	20	23	60	30	20	48	30	25	NV	NV	NV	30%

Task 6 Performs layout.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	40	40	50	32	0	20	40	22	30	35	NV	NV	NV	31%

Task 7 Fabricates components.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	40	40	30	45	40	50	40	30	40	40	NV	NV	NV	39%

BLOCK C CUTTING AND GOUGING

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	20	30	30	18	20	20	20	17	20	25	NV	NV	NV	22%

Task 8 Uses mechanical and power tools for cutting and grinding.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	10	40	20	19	20	40	25	42	40	25	NV	NV	NV	28%

Task 9 Uses oxy-fuel gas cutting process (OFC) for cutting and gouging.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	50	20	35	33	30	20	30	27	30	25	NV	NV	NV	30%

Task 10 Uses plasma arc cutting process (PAC) for cutting and gouging.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	20	20	30	26	20	30	20	20	15	20	NV	NV	NV	22%

Task 11 Uses air carbon arc cutting (CAC-A) gouging process.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	20	20	15	22	30	10	25	11	15	30	NV	NV	NV	20%

BLOCK D WELDING PROCESSES

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	50	35	40	46	35	60	30	37	30	50	NV	NV	NV	41%

Task 12 Welds using oxy-acetylene welding process.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
%	15	10	5	6	0	0	15	5	5	5	NV	NV	NV

7%

Task 13 Welds using shielded metal arc welding process (SMAW).

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
%	30	30	30	26	25	20	20	27	35	27	NV	NV	NV

27%

Task 14 Welds using flux cored arc welding process (FCAW), metal core arc welding process (MCAW) and gas metal arc welding process (GMAW).

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
%	30	20	30	32	50	50	20	30	30	42	NV	NV	NV

33%

Task 15 Welds using gas tungsten arc welding process (GTAW).

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
%	15	20	10	17	25	20	20	20	20	15	NV	NV	NV

18%

Task 16 Welds using submerged arc welding process (SAW).

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
%	5	10	10	12	0	5	15	13	5	6	NV	NV	NV

8%

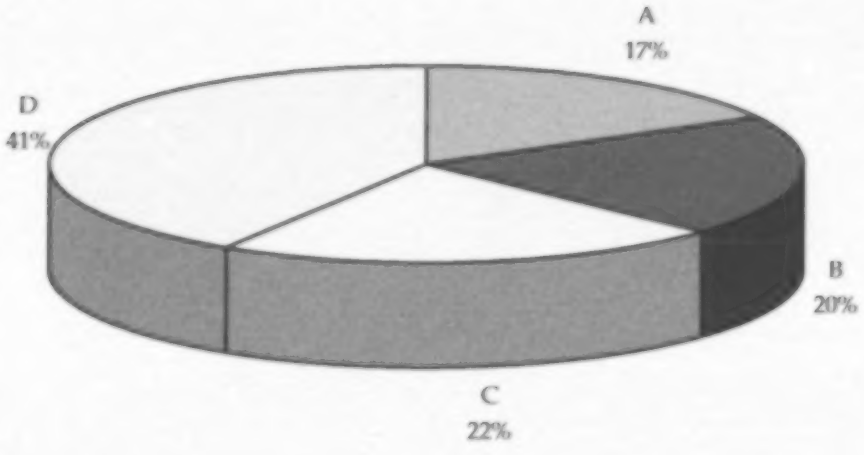
Task 17 Welds using other processes.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
%	5	10	15	7	0	5	10	5	5	5	NV	NV	NV

7%

APPENDIX E

PIE CHART*



TITLES OF BLOCKS

BLOCK A	Occupational Skills	BLOCK C	Cutting and Gouging
BLOCK B	Preparation for Welding Processes	BLOCK D	Welding Processes

* Average percentage of the total number of questions on an interprovincial examination, assigned to assess each block of the analysis, as derived from the collective input from workers within the occupation from all areas of Canada. Interprovincial examinations typically have from 100 to 150 multiple-choice questions.

APPENDIX F — TASK PROFILE CHART — Welder

	BLOCKS	TASKS	SUB-TASKS				
A	OCCUPATIONAL SKILLS	1. Maintains and uses tools and equipment.	1.01 Uses personal protective equipment (PPE) and safety equipment.	1.02 Maintains hand tools.	1.03 Maintains power tools.	1.04 Maintains stationary machinery.	1.05 Maintains layout and measuring tools.
			1.06 Maintains cutting and welding equipment.	1.07 Uses access equipment.			
		2. Organizes work.	2.01 Maintains safe work environment.	2.02 Uses documentation and reference material.	2.03 Interprets plans, drawings and specifications.	2.04 Communicates with others.	2.05 Compiles a list of materials and supplies.
			2.06 Plans project tasks.				
		3. Performs quality control.	3.01 Performs inspection.	3.02 Marks materials and parts.	3.03 Verifies layout.	3.04 Verifies measurements.	3.05 Performs heat treatment.
			3.06 Stores consumables.				
		4. Performs routine trade activities.	4.01 Performs hazard assessments.	4.02 Selects power source for welding processes.	4.03 Performs equipment start-up and shut down.		
B	PREPARATION FOR WELDING PROCESSES	5. Handles materials.	5.01 Obtains materials.	5.02 Verifies bill of materials.	5.03 Organizes materials.	5.04 Uses rigging, hoisting and lifting equipment.	5.05 Operates material handling equipment.
		6. Performs layout.	6.01 Develops templates.	6.02 Transfers dimensions from drawings to materials.			

BLOCKS	TASKS	SUB-TASKS				
	7. Fabricates components.	7.01 Prepares materials.	7.02 Fits components.	7.03 Tacks components.	7.04 Assembles components.	7.05 Finishes final product.
C CUTTING AND GOUGING	8. Uses mechanical and power tools for cutting and grinding.	8.01 Selects cutting and grinding tools.	8.02 Cuts using stationary band saws and power hacksaws.	8.03 Cuts using mechanical and hydraulic shears.	8.04 Cuts using hand tools.	8.05 Cuts using grinders.
		8.06 Cuts using circular saws.	8.07 Cuts using reciprocating saws.			
	9. Uses oxy-fuel gas cutting process (OFC) for cutting and gouging.	9.01 Selects oxy-fuel gas and equipment.	9.02 Sets up oxy-fuel equipment.	9.03 Sets operating parameters for oxy-fuel equipment.	9.04 Operates oxy-fuel equipment.	
	10. Uses plasma arc cutting process (PAC) for cutting and gouging.	10.01 Selects PAC gas, equipment and consumables.	10.02 Sets up PAC equipment.	10.03 Sets operating parameters for PAC.	10.04 Operates PAC equipment.	
	11. Uses air carbon arc cutting (CAC-A) gouging process.	11.01 Selects CAC-A equipment and consumables.	11.02 Sets up CAC-A equipment.	11.03 Sets operating parameters for CAC-A.	11.04 Operates CAC-A equipment.	
D WELDING PROCESSES	12. Welds using oxy-acetylene welding process.	12.01 Selects oxy-acetylene equipment and consumables.	12.02 Sets operating parameters for oxy-acetylene process.	12.03 Operates oxy-acetylene equipment.		
	13. Welds using shielded metal arc welding process (SMAW).	13.01 Selects SMAW equipment and consumables.	13.02 Sets up SMAW equipment.	13.03 Sets operating parameters for SMAW.	13.04 Operates SMAW equipment.	
	14. Welds using flux cored arc welding process (FCAW), metal core arc welding process (MCAW) and gas metal arc welding process (GMAW).	14.01 Selects FCAW, MCAW and GMAW gas, equipment and consumables.	14.02 Sets up FCAW, MCAW and GMAW equipment.	14.03 Sets operating parameters for FCAW, MCAW and GMAW.	14.04 Operates FCAW, MCAW and GMAW equipment.	

BLOCKS	TASKS	SUB-TASKS			
	15. Welds using gas tungsten arc welding process (GTAW).	15.01 Selects GTAW gas, equipment and consumables.	15.02 Sets up GTAW equipment.	15.03 Sets operating parameters for GTAW.	15.04 Operates GTAW equipment.
	16. Welds using submerged arc welding process (SAW).	16.01 Selects SAW equipment and consumables.	16.02 Sets up SAW equipment.	16.03 Sets operating parameters for SAW.	16.04 Operates SAW equipment.
	17. Welds using other processes.	17.01 Uses stud welding process (SW).	17.02 Uses resistance welding (RW) processes (Spot (RSW) and Seam (RSEW)).	17.03 Operates automated welding equipment.	